APPENDIX A

AUDITABLE SAFETY ANALYSIS

KAISER ♦ HILL
COMPANY

INTEROFFICE MEMORANDUM

DATE: February 10,1997

TO: Wayne R. Sproles, Mound Site Project Manager

FROM: D. R. Swanson, Manager, Safety Analysis, Bldg. 130, x7009

SUBJECT: TRANSMITTAL OF AUDITABLE SAFETY ANALYSIS FOR THE MOUND SITE SOURCE REMOVAL PROJECT - DRS-005-97

Ref: (a) W. R. Sproles ltr, 97-RF-00536, to Don Swanson, Mound Site, IHSS 113, Source Removal Project - Auditable Safety Analysis (ASA) - WRS-003-97, January 29, 1997

PURPOSE

This letter transmits the completed safety analysis for the Mound Site Source Removal Project in response to your letter (Ref. a) requesting an auditable safety analysis be performed.

DISCUSSION

This report presents a semi-quantitative safety analysis for the activities associated with the Mound Site Source Removal Project. The safety analysis was based on information obtained in the Proposed Action Memorandum (PAM) for the project, which includes a summary of the radiological and chemical sampling data, as well as a draft of the Mound Site Health and Safety Plan (HASP).

The safety analysis has determined that the Mound Site is classified as "low hazard non-nuclear" requiring compliance with OSHA Standards, preparation of a site-specific HASP, and preparation of an auditable safety analysis.

Based on the classification determination, the radiological and chemical hazards associated with the Mound Site source removal activities present negligible offsite impacts to the public and the environment resulting from an airborne release. Onsite occupational hazards have been identified and evaluated in the HASP. No additional controls, beyond what is documented in the HASP, have been identified, nor are necessary to further control negligible offsite radiological and chemical hazards. Offsite impacts will be adequately controlled provided that the controls identified in the HASP are implemented and maintained.

RESPONSE

If you have any comments or questions regarding this safety analysis, please contact John Kirar at x7844/DP7577 or myself at x7009/DP5269.

Attachment:
As stated

cc:
T. G. Hedahl
A. B. Reed
A. M. Tyson
M. R. Wood
J. J. Zimmer

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SAFETY ANALYSIS

for

INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) 113

MOUND SITE SOURCE REMOVAL PROJECT

Revision 0

February 10, 1997

Prepared by: J. S. Kirar, 2/10/97
Safety Analysis

Reviewed by: V. L. Peterson,
Safety Analysis

Approved by: D. R. Swanson,
Manager, Safety Analysis

Approved by: J. J. Zimmer,
Manager, Nuclear Engineering

Approved by: A. B. Reed,
RMRS

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SUMMARY

This safety analysis addresses the activities associated with the removal of Volatile Organic Compounds (VOCs) at the Rocky Flats Environmental Technology Site (RFETS), Individual Hazardous Substance Site (IHSS) 113. The IHSS 113 is also known as the Mound Site.

Between 1954 and 1958 approximately 1,405 intact drums containing uranium, plutonium, beryllium, hydraulic oil, carbon tetrachloride, perchloroethylene (PCE), and trichloroethylene (TCE) were stored at the Mound Site. Prior to removal of the drums, in 1970, some of the drums were known to have leaked, and the resulting contamination is impacting the groundwater. It is expected that approximately 400 to 1,000 cubic yards (yd^3) of soil are contaminated with VOCs above subsurface action levels specified in the Final Rocky Flats Cleanup Agreement (RFCA) (Ref. 1) necessitating source removal activities. The VOC contaminants are Comprehensive Environmental Response Compensation and Liability Act (CERCLA) hazardous substances and Resource Conservation and Recovery Act (RCRA) hazardous waste constituents contained in an environmental media (soil). Removal and treatment of VOCs at the Mound Site, in accordance with the RFCA, will mitigate this source of groundwater contamination.

Source removal activities include: (1) excavation, (2) staging of contaminated soils, (3) soil treatment, and (4) site reclamation. This analysis addresses only the tasks that could result in a significant airborne release of radiological and chemical contaminants, specifically, excavation, stockpiling, and handling of contaminated soils. Contamination of the local groundwater and potential resultant effects to public receptors are not addressed in this analysis as it is assumed that they are adequately covered by CERCLA and RCRA cleanup requirements applicable to this project. Routine and incidental releases of contaminants (chemical and radiological) during source removal activities at the Mound Site are evaluated in the *Site Specific Health and Safety Plan for the Source Removal at the Mound Site IHSS 113* (Ref. 2)

Based on a review of the *Proposed Action Memorandum for the Source Removal at the Mound Site, IHSS 113* (Ref. 3), the *Mound Site Source Removal Project Activity Control Envelope Process*, the site-specific HASP, and guidance set forth in DOE-STD-5502-94, *Hazard Baseline Documentation*, (Ref. 4), the Mound Site (source removal activities) is classified as "low hazard non-nuclear" requiring compliance with OSHA Standards, preparation of a site-specific Health and Safety Plan (HASP) in accordance with 29 CFR 1926.65, *Hazardous Waste Operations and Emergency Response* (Ref. 5), and preparation of an "auditable safety analysis." This safety analysis serves as the "auditable safety analysis."

Based on the "low hazard non-nuclear" hazard classification determination, the radiological and chemical hazards associated with the Mound Site source removal activities present negligible offsite impacts to the public and the environment. Onsite occupational hazards (radiological, chemical, biological, and physical) have been identified and evaluated in the site specific HASP hazard assessment. Controls for these hazards are also documented in the HASP No additional controls, beyond what is documented in the HASP, have been identified, nor are necessary to further control negligible offsite radiological and chemical hazards.

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SAFETY ANALYSIS

INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) 113

MOUND SITE SOURCE REMOVAL PROJECT

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1 INTRODUCTION

The proposed actions that will be undertaken at the Mound Site include excavating soil contaminated with VOCs and processing the soil to remove the VOCs. The Mound Site is located north of Central Avenue, and east of the protected area (PA) fence. The objective of the action is to prevent further degradation of groundwater and to protect human health and the environment. Following treatment, the soil will be returned to the site and the area revegetated. The project will be conducted in accordance with the RFCA guidelines, DOE Orders, and RFETS policies and procedures.

1.1 Regulatory Drivers

There are four primary regulatory thresholds or levels used for determining the hazard categorization and appropriate Environmental Management (EM) hazard baseline documentation:

- Hazard Category 3 per DOE Order 5480.23, *Nuclear Safety Analysis Reports* (Ref. 6) and DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports* (Ref. 7),
- 29 CFR 1910.119, *Process Safety Management (PSM)*(Ref. 8),
- 40 CFR 68, *Risk Management Programs (RMP) for Chemical Accidental Release Prevention* (Ref. 9), and
- 40 CFR 302, *Designation, Reportable Quantities, and Notification* (Ref.10)

DOE Order 5480.23 is the primary Order governing safety analysis requirements for nuclear facilities. Facilities are designated as "Nuclear Facilities" if the radiological inventory exceeds the threshold values in DOE-STD-1027-92. DOE-STD-1027-92 identifies the threshold between a Category 3 Nuclear Facility and a below Category 3 Nuclear Facility as a comparison of the total segmented inventory with the values in the standard.

The basis for the application of the PSM Standard, 29 CFR 1910.119, and RMP Rule, 40 CFR 68, is the inventory quantity of hazardous substances that is determined by gross amounts (unadjusted by process) of hazardous materials. The PSM Standard was promulgated to prevent and mitigate the effects of major accidents at chemical facilities that can result in loss of life to workers. The RMP Rule was promulgated to prevent and mitigate the effects of accidental releases of hazardous materials that could affect public health and/or the environment. The thresholds quantities (TQs) in 29 CFR 1910.119 and 40 CFR 68 are used to trigger PSM and RMP respectively, the results of which would be incorporated in the hazard baseline documentation. Based on the chemical inventory at the Mound Site excavation area, the PSM Standard and RMP Rule are not invoked.

The releasable quantities in 40 CFR 302, Appendix B, *Radionuclides*, are used to establish the dividing line between radiological or non-nuclear facilities and other EM industrial facilities. The levels in 40 CFR 302 are based on the reportable quantities in pounds of material for hazardous substances and curies of material for radioactive substances. Reportable quantities are based on the potential release of materials into the environment.

DOE-STD-5502-94 (Ref. 5) establishes uniform DOE Office of EM Guidance on hazard baseline documents that identify and control radiological and non-radiological hazards for all EM facilities. This DOE Standard requires the cognizant contractor to identify the activities, or groups of activities, that logically should be grouped as a "facility" for the purpose of facility classification and safety and health documentation development.

2 ACTIVITY DESCRIPTION

Source removal activities that will be performed at the Mound Site include:

- Excavation
- Staging of Contaminated Soil
- Soil Treatment
- Site Reclamation

2.1 Excavation

The proposed action involves excavating approximately 400 to 1,000 yd^3 of soil from the site using standard excavating equipment. Excavation equipment will consist of a track-mounted excavator, backhoe, and/or front-end loader. Contaminated soils will be moved in dump trucks or by similar transport to a contaminated soil feed stockpile, approximately 600 feet east of the Mound Site, south of where the thermal desorption treatment equipment will be placed to process the soil. During soil handling activities, dust minimization techniques, such as water sprays, will be used to minimize suspension of particulates. Earth-moving operations will not be conducted during periods of high sustained winds. Air monitoring for VOCs and radionuclides will be performed during excavation and transport activities. In addition, radiological monitoring of the soils will be performed for protection of the workers, the public, and the environment in accordance with the RFETS Radiological Controls Manual (Ref.11).

2.2 Staging of Contaminated Soil

The contaminated soil feed stockpile will be designed to contain the contaminated soil and minimize wind blown dispersion and storm water interaction with the soil by using concrete barriers and a water-resistant tarpaulin. In addition, a plastic lined ditch will be constructed surrounding the stockpile to capture local stormwater. Stormwater collected from this ditch may be used to control dust on soils awaiting treatment or will be collected for onsite treatment. Air monitoring for VOCs and radionuclides will be performed during staging of soils in the contaminated soil feed stockpile. Dust minimization will be performed during the staging of soils in the contaminated soil feed stockpile and a water-resistant tarpaulin or equivalent will be placed after daily stockpiling operations.

2.3 Soil Treatment

Contaminated soil will be treated using low temperature thermal desorption remediation technology and stockpiled in the treated soil stockpile area. Air monitoring for VOCs and radionuclides will be performed during soil treatment. Dust minimization will be performed

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during the treatment and staging of soils in the treated soil stockpile. Treated soil, upon attainment of performance goals, will be backfilled into the excavation. Reclamation of the treatment area and the excavation area will be performed to return these areas to natural conditions.

2.4 Site Reclamation

At the completion of remediation activities (excavation, soil treatment, and backfilling), radiological surveys of the Mound Site excavation and treatment areas will be performed and the areas revegetated. Excavation and thermal desorption equipment will be decontaminated.

3 SITE CHARACTERIZATION

3.1 Background

The Mound Site is located north of Central Avenue, and east of the protected area (PA) fence. Approximately 1,405 intact drums were placed at the Mound Site between 1954 and 1958 and covered with soil. The drums contained uranium and beryllium-contaminated lathe coolant (a mixture of approximately 70 percent hydraulic oil and 30 percent carbon tetrachloride). Historical information also indicates that some of the coolant contained plutonium. In addition, some of the drums contained tetrachloroethylene (or perchloroethylene) (PCE).

In 1970, all drums were removed from the Mound Site along with some radiologically contaminated soil. Approximately 10 percent of the drums were thought to have holes at the time of removal. No airborne radiological contamination was detected during the drum removal Recent characterization data indicates VOCs, predominantly PCE, have been detected in subsurface soils at levels requiring cleanup. Records, however, do not exist indicating the volume of contaminants released to the soils at the Mound Site.

Information on the Mound Site chemical and radiological contamination have been collected over many years and documented in various reports. These reports, referenced in the *Proposed Action Memorandum for the Source Removal at the Mound Site, IHSS 113* (Ref. 4), were used to prepare this safety analysis.

3.2 Radionuclides in Soil

Thirty-three samples have been collected from the Mound Site and analyzed for radionuclide content. The highest radiological concentration sample data, the mean concentration, and the 95% Upper Confidence Level (UCL) activity concentration from samples collected within the proposed Mound Site excavation area are provided in Table 3-1 (data from Ref. 4).

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Table 3-1 Concentration of Radionuclides

Radionuclide	Highest Concentration (pCi/g) (From borehole 14295 within the excavation area)	Mean Concentration (pCi/g) (From six boreholes within the excavation area)	95% UCL Concentration (pCi/g)
Uranium 233/234	18.41	4.37	9.36
Uranium 235	1.38	0.33	0.73
Uranium 238	101.10	20.20	47.07
Americium 241	0.36	0.09	0.19
Plutonium 239/240	1.91	0.47	1.00

3.3 Volatile Organic Compounds in Soil

Several subsurface soil and water samples were taken at the Mound Site. Maximum concentrations of VOCs in soil or water are shown in Table 3-2.

Table 3-2 Maximum Concentrations of VOC in Soil and Water Samples

Chemical Name	Concentration (ppm)	Location
Carbon Tetrachloride	0.005	Borehole 14495
Methylene Chloride	19.0	Borehole 14295
Perchloroethylene (PCE)	760.0	Borehole 14295
Trichloroethylene (TCE)	18.0	Groundwater Well 0174

Borehole 14295 and 14495 locations are within the proposed Mound Site excavation area.

4 HAZARD ANALYSIS

4.1 Hazard Categorization Methodology - Radiological

The total activity of each identified radionuclide present at the Mound Site excavation, assumed to be the total 1,000 yd^3 that will be excavated and treated, was estimated using the formula below and the 95% UCL activity concentrations from Table 3-1. The total activity of each radionuclide was compared to the Category 3 thresholds in DOE-STD-1027-92. The ratio of the total activity to the 40 CFR 302 Appendix B Reportable Quantities (RQs) was then determined. Finally, the sum of these ratios was compared to unity to determine if the potentially releasable radiation from the Mound Site excavation exceeds the 40 CFR 302 notification requirements. Results of the calculations are provided in Table 4-1.

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A_T = Total Activity (pCi) = A x ρ x V

A = 95% UCL activity concentration, pCi/g from Table 3-1

ρ = soil density = 1.8 g/cm^3

V = soil volume excavated = 1,000 yd^3 = 27,000 ft^3

The total activity for each isotope was calculated as follows:

For U^{233}/U^{234}

A_T = 9.36 pCi/g x 1.8 g/cm^3 x 27,000 ft^3 x (1 cm^3/3.53 x 10^{-5} ft^3)

A_T = 1.29 x 10^{10} pCi (~0.013 Ci)

For U^{235}

A_T = 0.73 pCi/g x 1.8 g/cm^3 x 27,000 ft^3 x (1 cm^3/3.53 x 10^{-5} ft^3)

A_T = 1.01x 10^9 pCi (~0.001 Ci)

For U^{238}

A_T = 47.07 pCi/g x 1.8 g/cm^3 x 27,000 ft^3 x (1 cm^3/3.53 x 10^{-5} ft^3)

A_T = 6.48 x 10^{10} pCi (~0.065 Ci)

For Am^{241}

A_T = 0.19 pCi/g x 1.8 g/cm^3 x 27,000 ft^3 x (1 cm^3/3.53 x 10^{-5} ft^3)

A_T = 2.62 x 10^8 pCi (~0.00026 Ci)

For Pu^{239}/Pu^{240}

A_T = 1.00 pCi/g x 1.8 g/cm^3 x (1 cm^3/3.53 x 10^{-5} ft^3) x 27,000 ft^3

A_T = 1.38 x 10^9 pCi (~0.0014 Ci)

Table 4-1 Radionuclide Quantities at Mound Site

Radionuclide	Total Activity in 1,000 yd^3 of Soil, Ci	DOE-STD-1027, Attachment 1 Category 3 Thresholds, Ci	40 CFR 302.4 Appendix B RQ, Ci	Ratio (Activity/RQ)
Uranium 233/234	0.013	4.2	0.1	0.13
Uranium 235	0.001	4.2	0.1	0.01
Uranium 238	0.065	4.2	0.1	0.65
Americium 241	0.00026	0.52	0.01	0.026
Plutonium 239/240	0.0014	0.52	0.01	0.14
Total Sum-of-Ratios				0.956

4.2 Hazard Classification Methodology - Chemical

The total quantity of each identified chemical contaminant present at the Mound Site excavation, assumed to be the total 1,000 yd^3 that will be excavated and treated, was estimated using the formula below and the maximum detected concentrations from Table 3-2. The ratio of the individual concentration of each chemical to the 40 CFR 302 Appendix B Reportable Quantities (RQs) was then determined. Finally, the sum of these ratios was compared to unity to determine if the potentially releasable chemicals from the Mound Site excavation exceeds the 40 CFR 302 notification requirements. Results of the calculations are provided in Table 4-2.

Q = quantity of chemical (mg) = C x ρ x V

C = concentration, mg/kg from Table 3-2

ρ = soil density = 1.8 g/cm^3

V = soil volume excavated = 1,000 yd^3 = 27,000 ft^3

The total quantity for each chemical constituent was calculated as follows:

For Carbon Tetrachloride

Q = 0.005 mg/kg x (1kg/1000g) x 1.8 g/cm^3 x 27,000 ft^3 x (1 cm^3/3.53 x 10^{-5} ft^3)

Q = 6.88 x 10^3 mg (~0.0069 kg)

Methylene Chloride

Q = 19.0 mg/kg x (1kg/1000g) x 1.8 g/cm^3 x 27,000 ft^3 x (1 cm^3/3.53 x 10^{-5} ft^3)

Q = 2.62 x 10^7 mg (~26 kg)

Perchloroethylene (PCE)

Q = 760.0 mg/kg x (1kg/1000g) x 1.8 g/cm^3 x 27,000 ft^3 x (1 cm^3/3.53 x 10^{-5} ft^3)

Q = 1.046 x 10^9 mg (~1,050 kg)

Trichloroethylene (TCE)

Q = 18.0 mg/kg x (1kg/1000g) x 1.8 g/cm^3 x 27,000 ft^3 x (1 cm^3/3.53 x 10^{-5} ft^3)

Q = 2.48 x 10^7 mg (~25 kg)

Table 4-2 Chemical Quantities at Mound Site

Chemical	Quantity present in 1,000 yd^3 of Soil, kg	40 CFR 302.4 RQ, kg	Ratio (Quantity/RQ)
Carbon Tetrachloride	0.0069	4.54	0.0015
Methylene Chloride	26	45.4	0.57
Perchloroethylene (PCE)	1,050	45.4	23
Trichloroethylene (TCE)	25	45.4	0.55
Total Sum-of-Ratios			24.12

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4.3 Final Hazard Categorization

Based on the guidance in DOE-STD-5502-94, the Mound Site (source removal activities) is classified as "low hazard non-nuclear" requiring compliance with applicable OSHA Standards, preparation of a site specific Health and Safety Plan (HASP), and preparation of an "auditable safety analysis." This classification was determined as follows:

- Potentially releasable radiation does not meet or exceed DOE-STD-1027, Attachment 1 thresholds (see Table 4-1), and
- Potentially releasable radiation RQ does not meet or exceed 40 CFR 302, Appendix B levels (see Table 4-1), and
- Potentially releasable hazardous chemical RQ exceeds 40 CFR 302, Table 40 CFR 302 levels (see Table 4-2).

This safety analysis serves as the "auditable safety analysis" required to meet DOE-STD-5502-94. The Mound Site-specific HASP: (1) provides systematic identification of hazards within the source removal activities, (2) describes and analyzes the adequacy of the measures taken to eliminate, control, or mitigate identified hazards, and (3) analyzes and evaluates potential accidents.

4.4 Hazard Analysis Results

Based on the "low hazard non-nuclear" hazard classification determination, the radiological hazards associated with the Mound Site source removal activities present negligible offsite impacts to people and the environment. Therefore, no radiological accident scenarios resulting in the release of radionuclides have been analyzed in this safety analysis.

For chemicals, the amount present in the total quantity of soils that will be excavated and treated exceeds the 40 CFR 302 levels. However, the amount that evaporates from the soil as it is handled should be negligible compared to these levels. The potential for release of VOCs during thermal desorption will be adequately controlled by treatment unit design (i.e., capture of off-gases, air monitoring for VOCs, HEPA filtration to minimize particulate emissions). Therefore, no accident scenarios resulting in the release of chemicals have been analyzed in this safety analysis.

Occupational hazards, including common industrial hazards (chemical exposures, biological hazards, and physical hazards), are identified and evaluated in the site-specific HASP (Ref. 2) and are clearly regulated by DOE-prescribed occupational safety and health standards. No specific analysis was performed for these types of hazards as part of this safety analysis.

5 HAZARD CONTROLS

Controls for onsite radiological, chemical, biological, and physical hazards associated with source removal activities at the Mound Site are prescribed in the site-specific HASP. No additional controls, beyond what is documented in the HASP, are necessary to control negligible offsite radiological and chemical hazards. Offsite impacts will be adequately controlled provided that the controls identified in the HASP are implemented and maintained.

6 REFERENCES

1 *Final Rocky Flats Cleanup Agreement (RFCA),* DOE, Rocky Flats environmental Technology Site, 1996.

2 *Draft Site Specific Health and Safety Plan for the Source Removal at the Mound Site IHSS 113,* **RF/RMRS-96-0061,** Rocky Mountain Remediation Services, LLC, January 1997.

3 *Proposed Action Memorandum for the Source Removal at the Mound Site, IHSS 113,* **RF/RMRS-96-0059,** Rocky Mountain Remediation Services, LLC, December 16, 1996.

4 *Hazard Baseline Documentation,* **DOE Limited Standard 5502-94,** U. S. Department of Energy, Washington D. C., August 1994.

5 *Hazardous Waste Operations and Emergency Response,* **Code of Federal Regulations, 29 CFR 1926.65,** Department of Labor, Occupational Safety and Health Administration, Washington D. C.

6 *Nuclear Safety Analysis Reports,* **DOE Order 5480.23,** U. S. Department of Energy, Washington D. C., April 30, 1992.

7 *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports,* **DOE Standard 1027-92,** U. S. Department of Energy, Washington D. C., December 1992.

8 *Process Safety Management,* **Code of Federal Regulations, 29 CFR 1910.119,** Department of Labor, Occupational Safety and Health Administration, Washington D. C.

9 *Risk Management Programs (RMP) for Chemical Accidental Release Prevention,* **Code of Federal Regulations, 40 CFR 68,** Office of the Federal Register, Washington D. C.

10 *Designation, Reportable Quantities, and Notification,* **Code of Federal Regulations, 40 CFR 302,** Office of the Federal Register, Washington D. C.

11 *RFETS Radiological Controls Manual,* Kaiser-Hill, Rocky Flats environmental Technology Site, 1996.